(Translation)

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Inventor: Naoaki Kano
Applicant: Fujitsu Ltd.

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1. Title of Invention: Multi-link System

2. Claim for Patent:

(1) A multi-link system having:

transmission procedure processing means (113,114) for performing protocol control correspondingly to a plurality of channels (111, 112); and

transmission request processing means (115) for setting, for each of the transmission procedure processing means (113,114) the respective window sizes to determine the data quantity capable of being transmitted continuously, to thereby perform the transmission request processing in response to the window sizes; characterized by further comprising:

channel monitoring means (117) for monitoring the data processing quantity for each of said channels (111, 112), and instructing to said transmission request processing means the change of window size for each of said channels in response to the monitored processing ratio.

3. Detailed Description of Invention:

[Summary]

The present invention relates to a multi-link system for a plurality of channels with controllable windows. An object of the invention is to change the window size in response to the quantity of data being processed for each of the channels.

The present invention lies in a multi-link system having:

transmission procedure processing means for performing protocol control correspondingly to a plurality of channels; and transmission request processing means for setting, for each of the transmission procedure processing means the respective window sizes to determine the data quantity capable of being transmitted continuously, to thereby perform the transmission request processing in response to the window sizes; characterized by further comprising: channel monitoring means for monitoring the data processing quantity for each of said channels, and instructing to said transmission request processing means the change of window

size for each of said channels in response to the monitored processing ratio.

[Field of use]

The present invention relates to a multi-link system for a plurality of channels with controllable windows.

[Prior art]

A multi-link system is a control procedure for connecting mutually communicating equipment through a plurality of channels with a view to enhancing the transmission capacity and reliability.

Fig.5 shows a system make-up of a multi-link system.

In Fig.5, equipment A and B are connected by three channels 1, 2 and 3, wherein the multi-link-based channel control is performed to establish and release the data link through the HDLC procedure.

On the other hand, a data communication system has a flow control and other traffic control to achieve smooth data transfer. The window-based control system, which is among the traffic control techniques, determines the data quantity (window size) which the transmit side equipment can continuously transmit depending on the buffer capacity on the receive side, while performing the transmission control thereby to limit the data quantity to a value below the window size and while preventing the subsequent data transmission from being performed until the admission to transmission is received from the receive side.

Fig.6 schematically shows a conventional system in which the window-based control system is adopted for the control of a plurality of channels by the multi-link system.

In Fig.6, channels 1, 2 and 3 have their respective transmit procedure control units 610, 620 and 630 for the respective protocol control. The transmit request processing unit 640 sets up windows 611, 621 and 631 respectively at these transmit procedure control units 610, 620 and 630 for the control of data transmission. Also, the transmit request processing unit 640 performs for the respective windows the transmit request processing for the data stored in buffer 641.

In the above-mentioned conventional multi-link system, in which the size of each of the windows 611, 621 and 631 is fixed, the transmit request processing unit 640 performs for the respective transmit procedure units 610, 620 and 630 the transmit request for the fixed size windows, without regard to the quality of channels 1 to 3.

[Problems to be solved]

When the quality of a channel is deteriorated resulting in the delay in the renewal of the corresponding window, the conventional system cannot avoid the decrease in the overall quantity of the transmitted data because of the fixed size of the windows for the respective channels. This results in the data pile-up in buffer 641 due to the lowered processing efficiency of the transmission request at transmission request processing unit 640.

Furthermore, in a channel with the deteriorated quality, the period of time from the receipt of a transmission request to the completion of transmission, i.e., the data transmission delay, is increased significantly, because of the fixed-window-size-based processing of data transmission.

It is an object of this invention to provide a multi-link system capable of changing the size of the respective windows depending on the quantity of data to be processed for each of the channels under the control thereby.

[Means by which the problems are solved]

Fig.1 schematically shows the principle of the multi-link system of this invention.

In Fig.1, transmission procedure processing means 113 and 114 perform the respective protocol control for channels 111 and 112.

Transmission request processing means 115 sets the size of the respective windows, which determines the quantity of data that can be continuously transmitted, for the respective transmission procedure processing means 113 and 114, and performs the data transmission request processing depending on the window size.

Channel monitoring means 117, which monitors the quantity of data processed respectively for channels 111 and 112, instructs the change in the window size for the respective channels, depending on the ratio of the quantities of data processed.

[Function]

In the present invention, channel monitoring means 117, which monitors the quantity of data processed respectively for channels 111 and 112, instructs transmission request processing means 115 to change the size of windows respectively for the channels, depending on the ratio of the quantities of data processed.

Thus, transmission request processing means 115 can set the size of the windows depending on the quantity of data processed for the respective channels. More specifically, the size of the windows is reduced for those channels which have experienced the decrease in the data to be processed due to the deterioration of

the quality thereof, while the size of the windows is relatively enlarged for normal channels, so that the summation of the overall window sizes may be kept constant for the respective channels.

[Embodiment]

An embodiment of the invention will now be described in detail referring to the accompanying drawings.

Fig.2 shows in blocks the system according to the invention.

In Fig.2, transmission request processing unit 240 sets the size of the windows 211, 221 and 231, respectively of transmission procedure control units 210, 220 and 230, thereby to limit the quantity of data to be stored in the buffer 241 to a value below the respective window sizes and to perform the transmission request processing for transmission procedure control units 210, 220 and 230. Those transmission procedure control units 210, 220 and 230 which have received the requests perform the protocol control for the corresponding channels and transmit the requested data.

Transmission processing status monitoring unit 250, which monitors the response status of each of the channels, gives the instruction of window-size change to transmission request processing unit 240, to thereby achieve the change of the size of the respective windows 211, 221 and 231 in response to the monitoring results. Transmission request processing unit 240 performs the window-size change responsive to the window-size change instruction.

Fig.3 is a flow chart for the processing performed at the transmission processing status monitoring unit 250, and Fig.4 illustrates examples of the change of window size. The operation of the embodiment will now be described referring to Figs. 2 to 4.

At the start of the processing, the window size for the whole of the system is set at 15, while that for each of the three channels is set at 5 (the ratio of data processing for the channels is 1:1:1).

Transmission processing status monitoring unit 250, which monitors the number of transmitted data (quantity of processed data) at transmission procedure control units 210, 220 and 230 based on the response from the respective channels, and calculates the ratio of the quantity of data processed at the respective transmission procedure control units.

When the above-mentioned data processing ratio becomes 2:1:2 dues to the deterioration in the quantity of channel 2, the transmission processing status monitoring unit 250 conveys that data processing ratio to transmission request processing unit 240. Based on the supplied data processing ratio, transmission request processing unit 240 performs calculation for reassignment of the

total window size (15) of the system. In this example, the window sizes reassigned for the respective channels become 6, 3 and 6, resulting in the change of setting of the sizes of windows 211, 221 and 231 by transmission request processing unit 240.

As described above, according to this invention, the window size for a quality-deteriorated channel is decreased, while that for other normal channels is increased, to thereby maintain the total quantity of data processing of the system at a constant value.

There may be a situation in the reassignment of the window sizes, where the reassignment cannot be made on an iteger ratio basis for the respective channels, depending on the data processing ratio and the total window size. Since it is difficult to significantly change the total window size of a system, the present invention either slightly modifies the total window size, or sets those window sizes for respective channels which approximately reflect the data processing ratio, with the total window size unchanged.

[Effects of the invention]

Since the present invention maintains the total quantity of transmitted data at that of normal state, by reassigning the window sizes depending on the data processing ratio of the respective transmission channels, the data pile-up at the buffer can be avoided. Also, since the window sizes for the channels of lowered processing capability are decreased, the increase of data transmission delay for the requested transmission in those channels can be avoided.

Therefore, it is possible for the present invention to enhance the data processing efficiency and network reliability of a multi-link based system.

4. Brief Description of Drawings:

Fig.1 schematically shows in blocks the principle of the present invention;

Fig.2 shows a block diagram of the present invention;

Fig.3 is a flow chart of the processing performed at the transmission processing status monitoring unit;

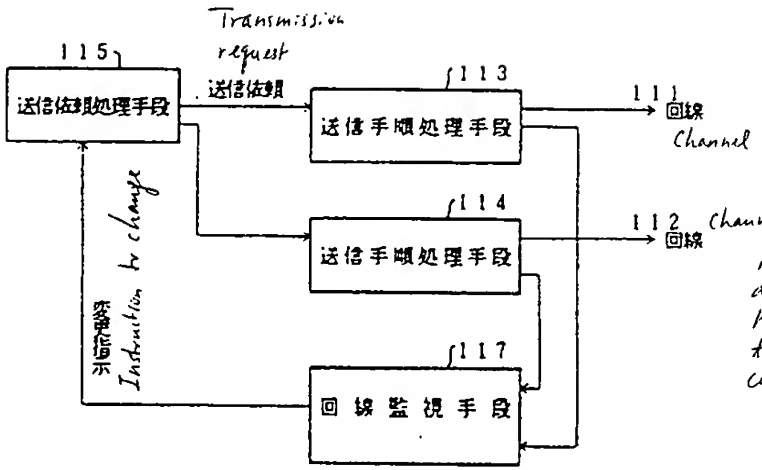
Fig.4 shows an example of the window-size change performed in the embodiment;

Fig.5 shows a system make-up of a multi-link-based system;

Fig.6 schematically shows a prior art system.

In the drawings, reference numerals 111 and 112 denote channels; 113 and 114, transmission procedure processing means;

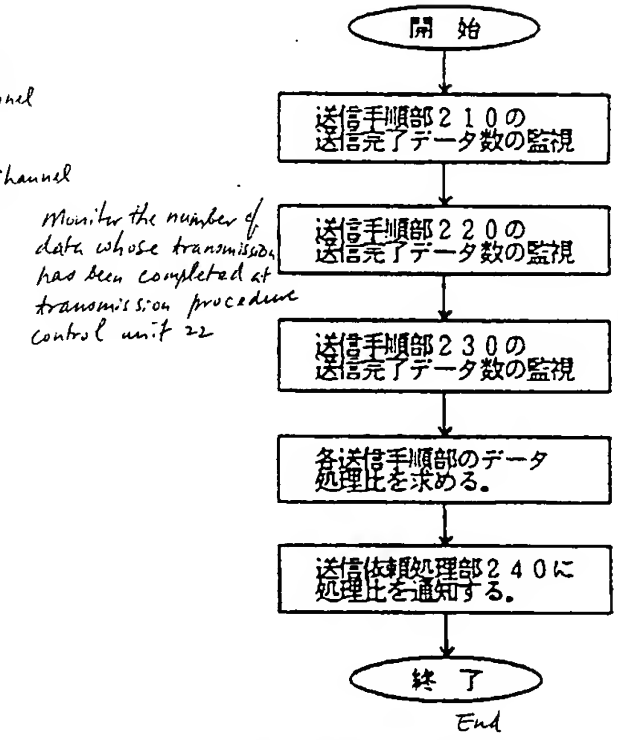
115, transmission request processing means; 117, channel monitoring means; 210, 220, 230, 610, 620 and 630, transmission procedure control unit; 211, 221, 231, 611, 621 and 631, windows; 240 and 640, transmission request processing unit; 241 and 641, a buffer; and 250, transmission processing status monitoring unit.



本発明の原理ブロック図

第 1 図

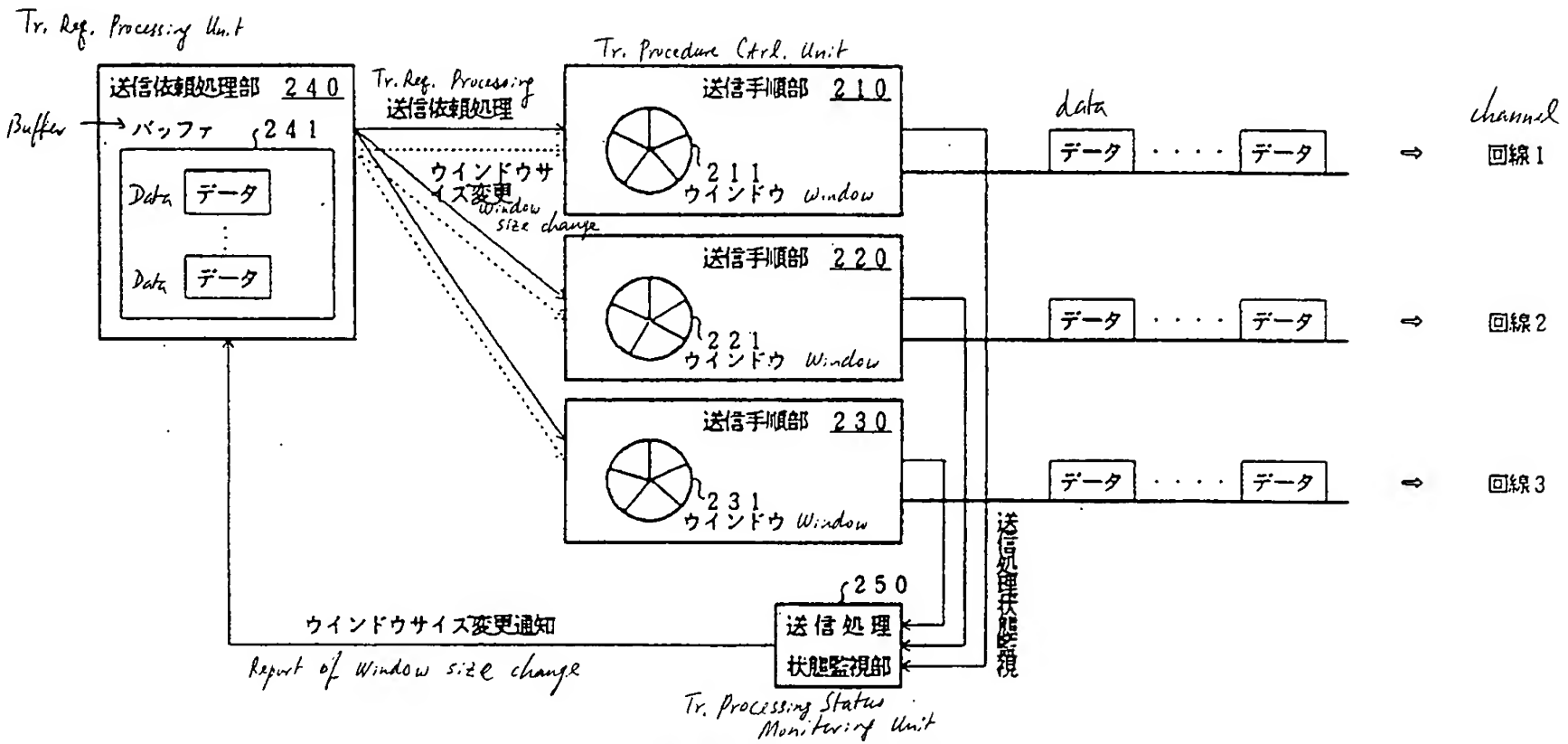
Block diagram of the principle of the invention



送信処理状態監視部の処理の流れ図

第 3 図

Flow chart of the processing at the transmission processing status monitoring unit



実施例構成を示すブロック図

第 2 図

Block diagram of embodiment

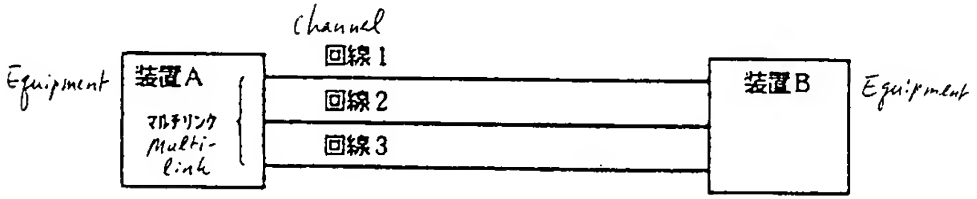
Ordinary State　Modified State

Ratio of quantity of data processed　Window　Ratio of quantity of data processed　Window

		通常状態		変更状態	
		処理比	ウインドウ	処理比	ウインドウ
Channel	回線1	1	Size サイズ 5	2	サイズ 6
channel	回線2	1	サイズ 5	1	サイズ 3
channel	回線3	1	サイズ 5	2	サイズ 6

Example of modified window sizes in the embodiment
実施例のウインドウサイズの変更例を示す図

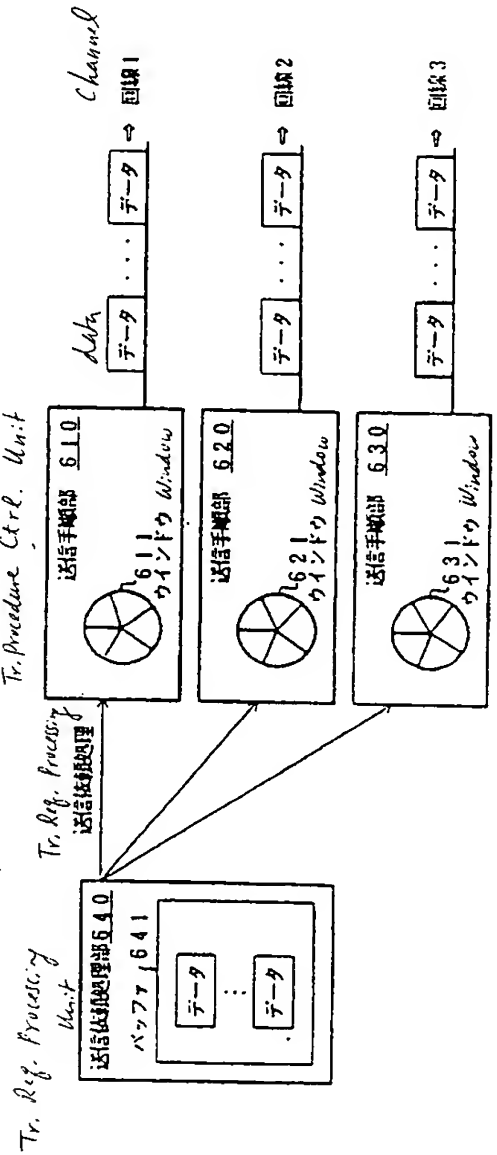
第 4 図



マルチリンク方式のシステム構成図

第 5 図

System make-up of multilink system



Schematic Diagram of Conventional System
従来方式の概要を説明する図

第 6 図